Produced Water Project

San Juan Generating Station

PNM Water Issues in the San Juan Basin…..

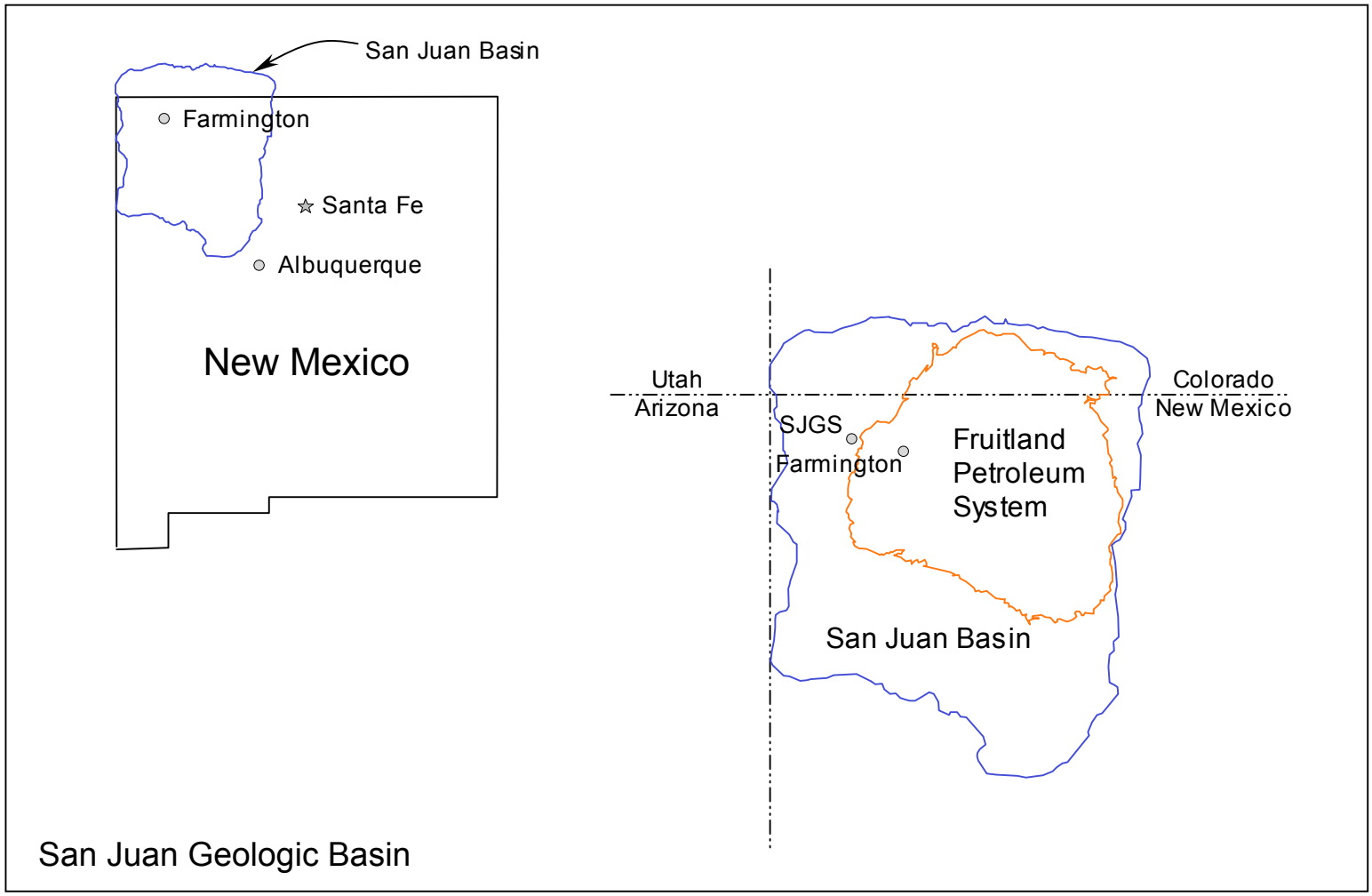
- San Juan Generating Station (SJGS) consumes 22,000 acre-feet of water per year (467,600 BPD or 13,640 gpm).
- SJGS is a base-loaded plant and needs a reliable source(s) of water to operate.
- Researchers at the University of Arizona predict an extended drought for the region – possibly lasting 40 to 50 years.
- SJGS is a long-term energy production site and will be there 25 years or more.
- PNM has negotiated short-term and long-term water contracts to ensure supply, however if a severe a drought develops water contracts are irrelevant.
- If SJGS uses less water through conservation and obtains alternative supplies (e.g. produced water), more water will be available for other beneficial uses.

One drought scenario…..

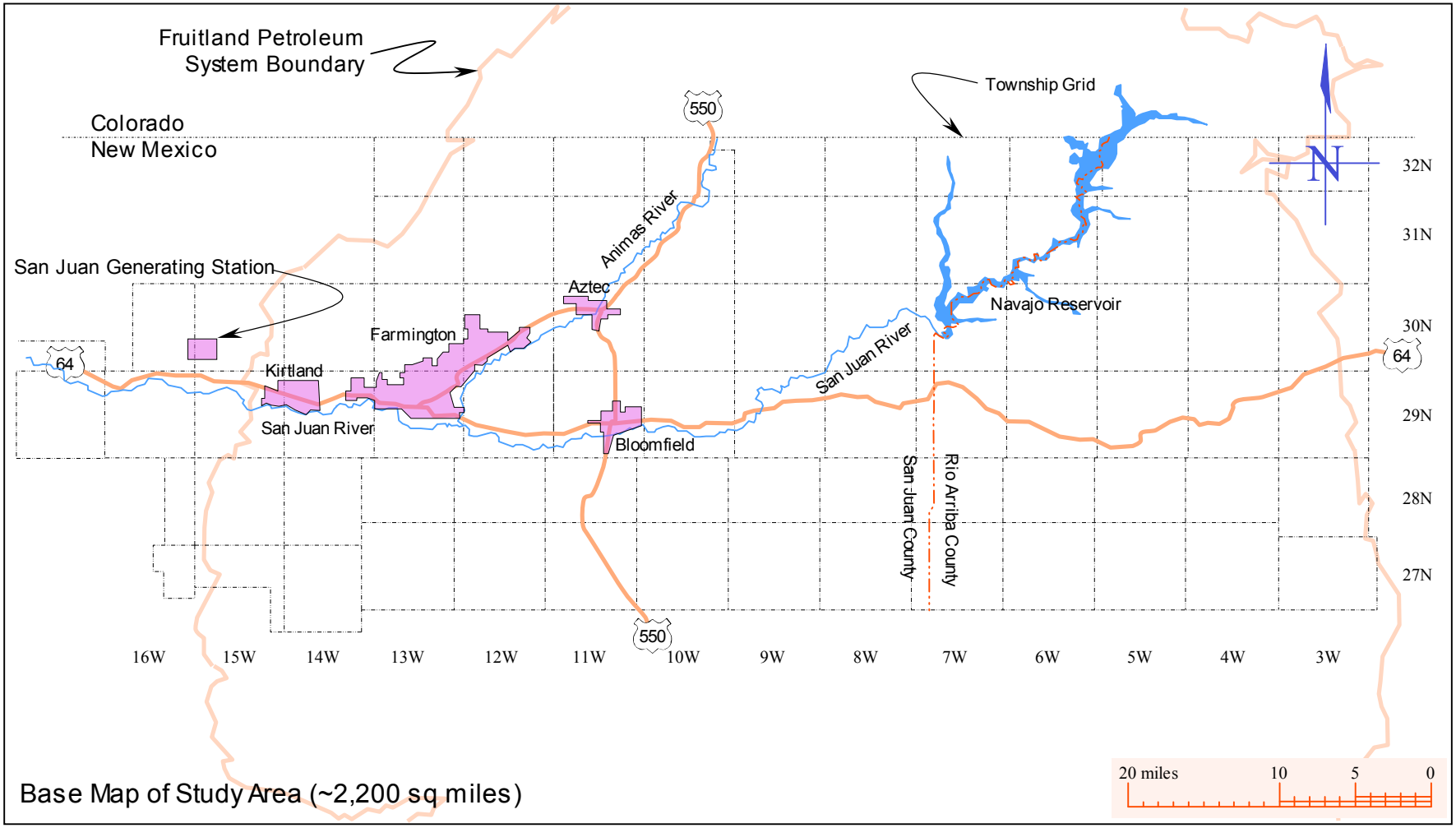
- SJGS has to reduce power by 10% for an entire year.
- SJGS has a long-term take-or-pay fuel contract, i.e. PNM must pay for fuel whether it uses it or not.
- SJGS will have to purchase power from other generators (most likely gas-fired combined cycle plants).
- The financial impact for this scenario could be in excess of $45 million per year.
- PNM has looked at scenarios where water reductions approach 30%.

The basis for this project was to provide supplemental water to avoid or minimize the financial impact of such a scenario.....

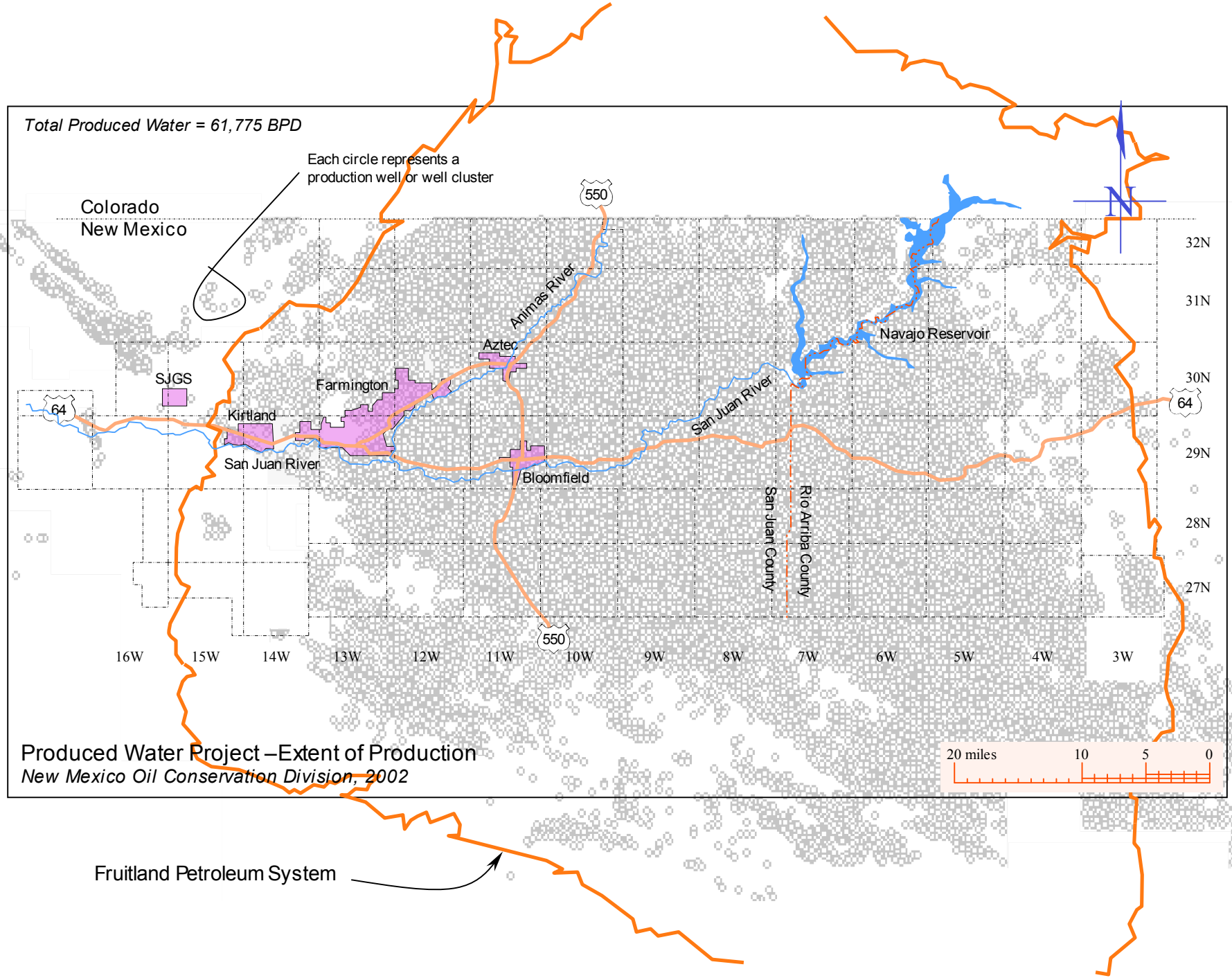
Project Setting



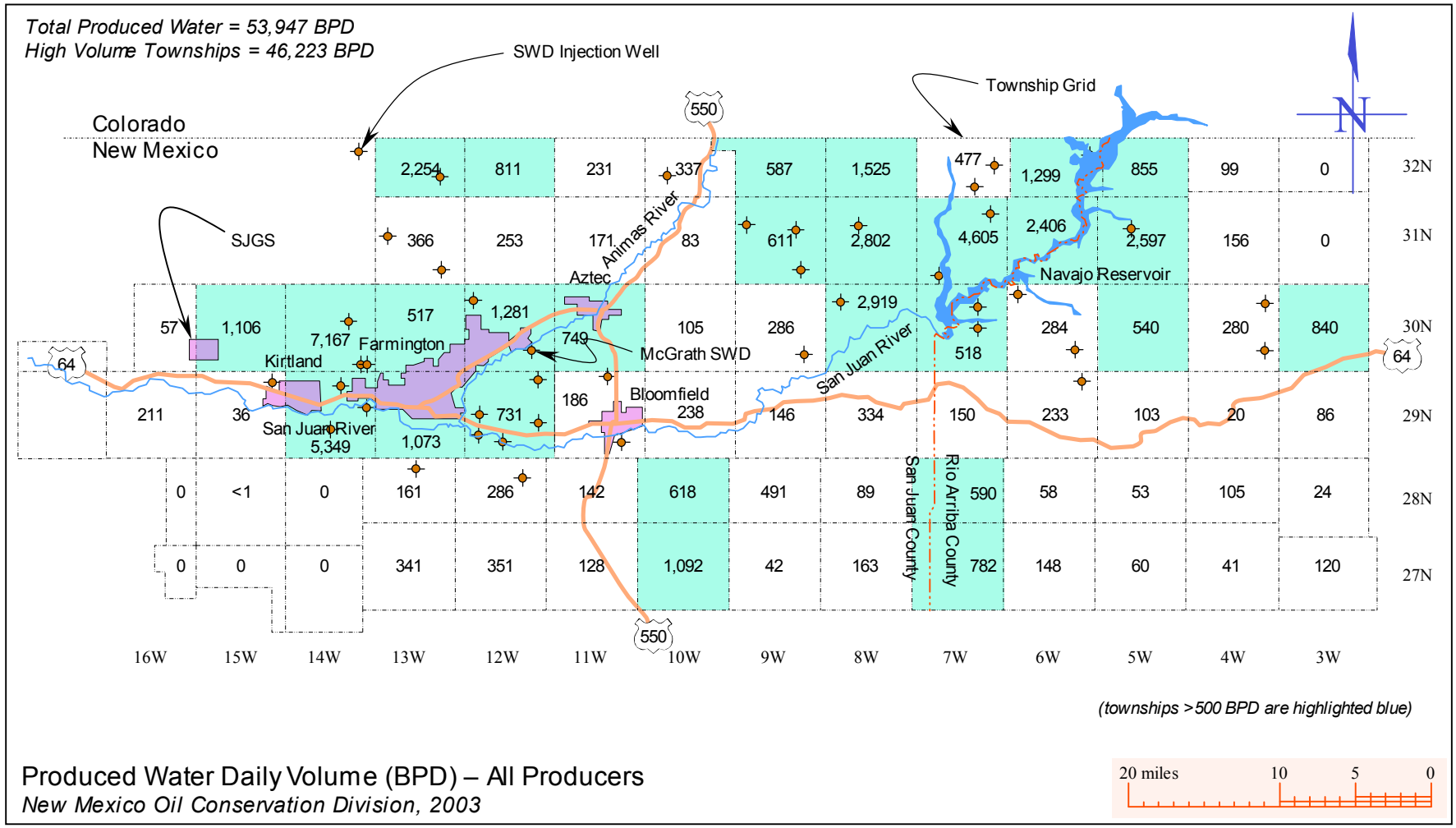
San Juan Geologic Basin



Base Map of Study Area (~2,200 sq miles)

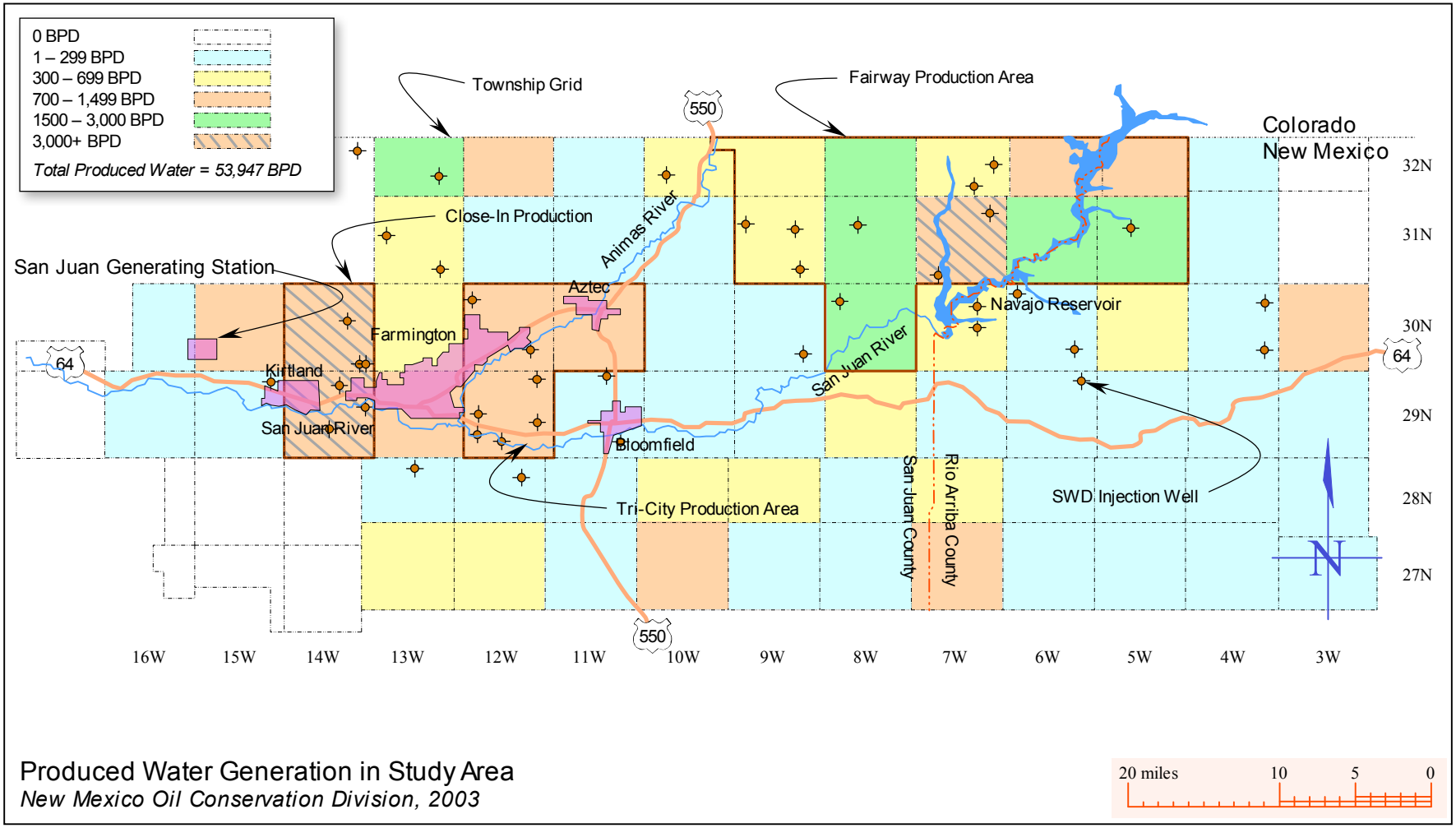

Total Produced Water = 61,775 BPD
Each circle represents a production well or well cluster
Colorado
New Mexico
550
Animas River
Aztec
Farmington
SJGS
64
Kirtland
San Juan River
Bloomfield
San Juan River
Navajo Reservoir
San Juan County
Rio Arriba County
64
550
32N
31N
30N
29N
28N
27N
16W
15W
14W
13W
12W
11W
10W
9W
8W
7W
6W
5W
4W
3W
N
20 miles
10
5
0
Produced Water Project –Extent of Production
New Mexico Oil Conservation Division, 2002
Fruitland Petroleum System

Production is quite dispersed.....



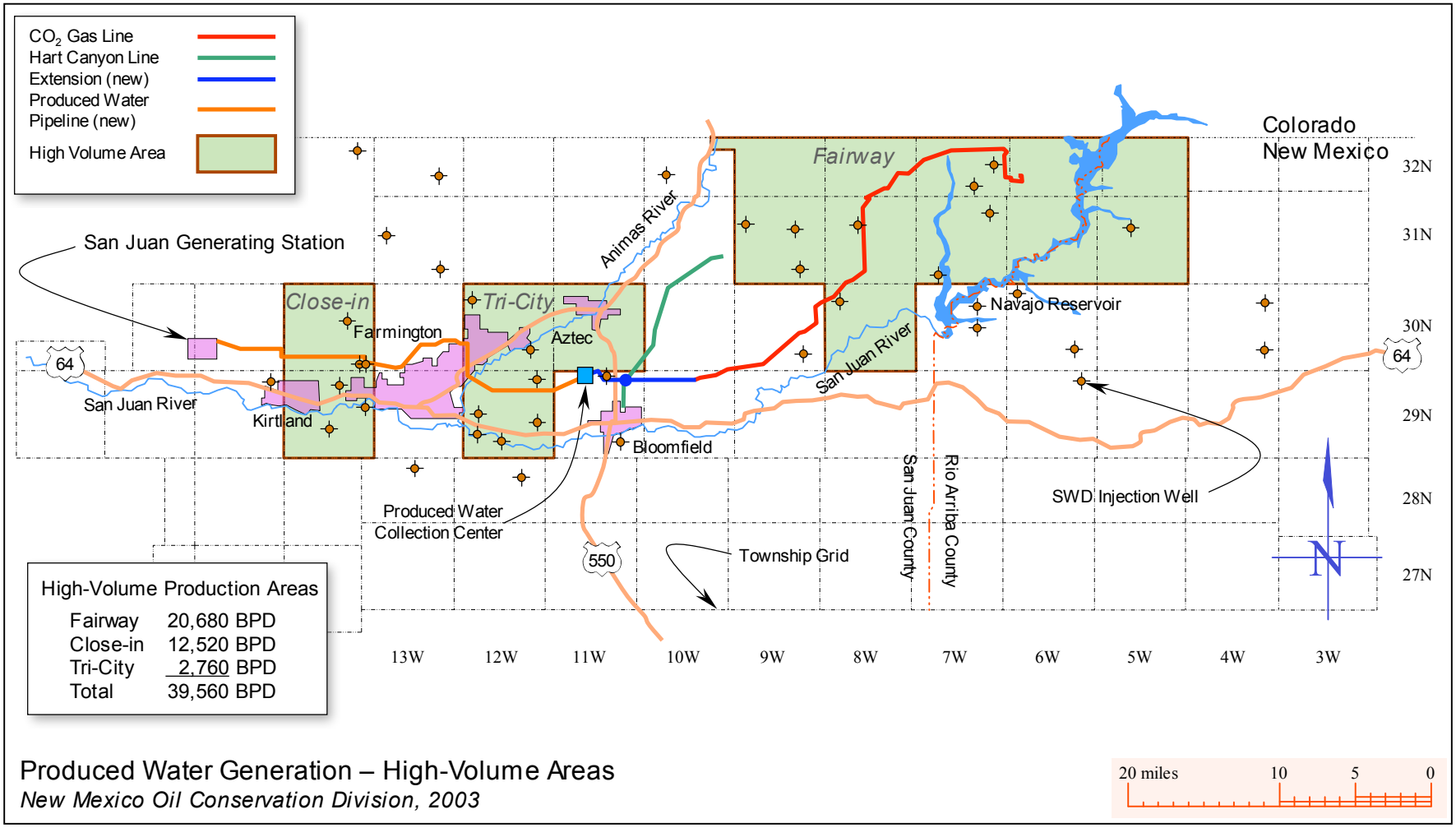
Produced Water Daily Volume (BPD) – All Producers

New Mexico Oil Conservation Division, 2003



Produced Water Generation in Study Area

New Mexico Oil Conservation Division, 2003



High-Volume Production Areas	
Fairway	20,680 BPD
Close-in	12,520 BPD
Tri-City	2,760 BPD
Total	39,560 BPD

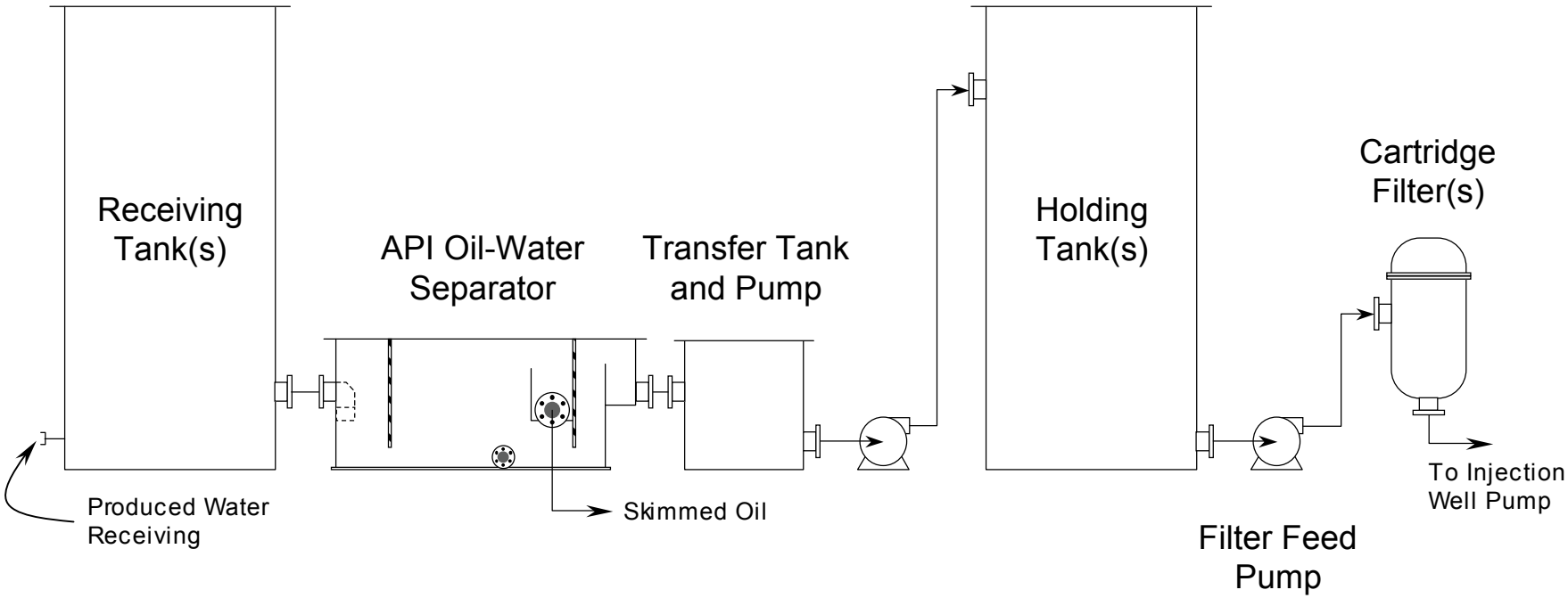
Produced Water Generation – High-Volume Areas

New Mexico Oil Conservation Division, 2003

Salt Water Disposal Facilities (SWDs)

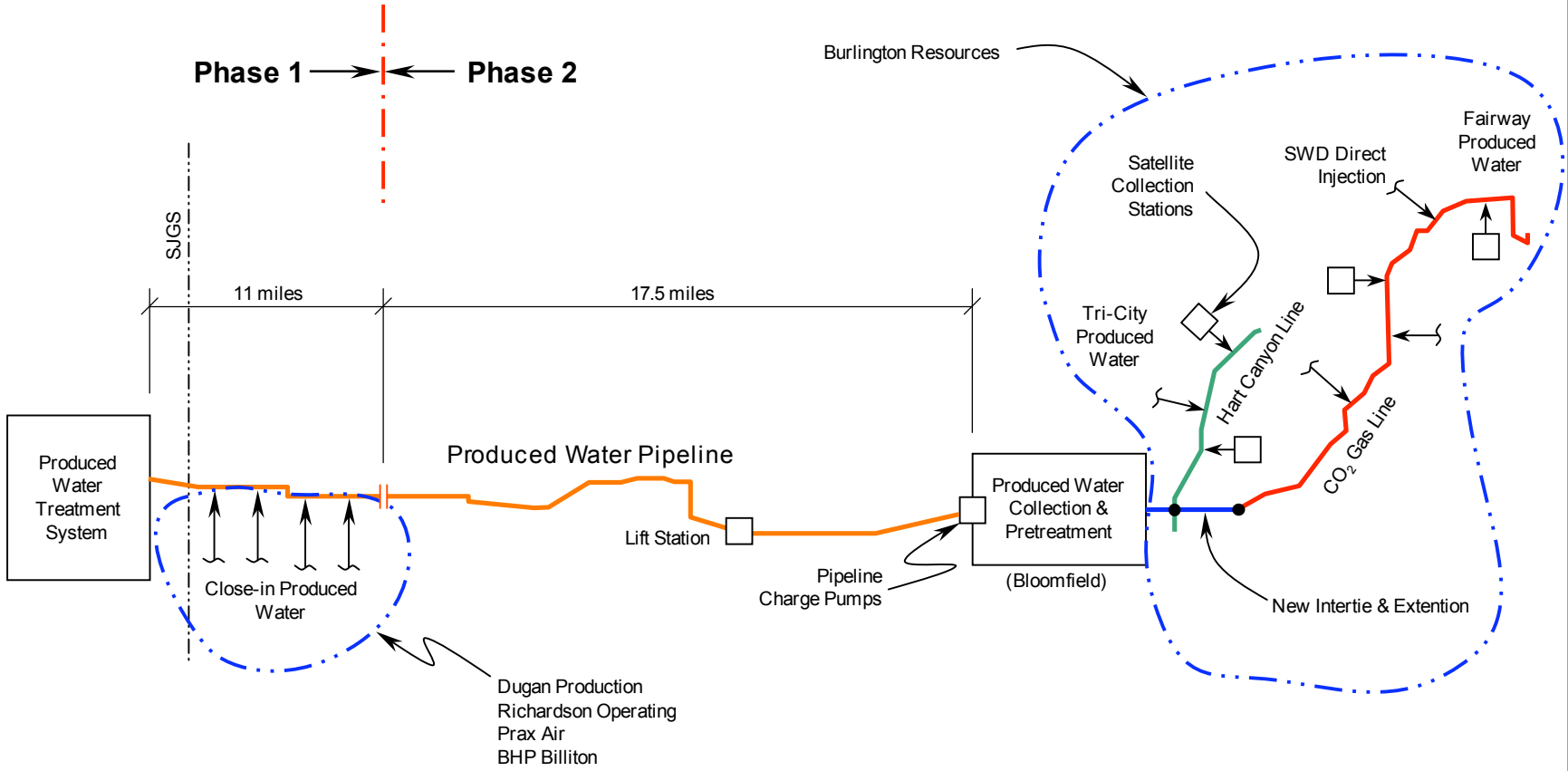
McGrath SWD (Salt Water Disposal) Facility

McGrath is a large, well-operated SWD near Farmington, New Mexico. Produced water generated at the wellhead is transported by tanker trucks to SWDs. At the SWD, oil is separated from the produced water. The water is then filtered and injected into a non-producing formation at depths that sometimes reach 5,000 feet. In some locations, injection pressures exceed 1,500 psi. There are 53 SWDs in the San Juan Basin.



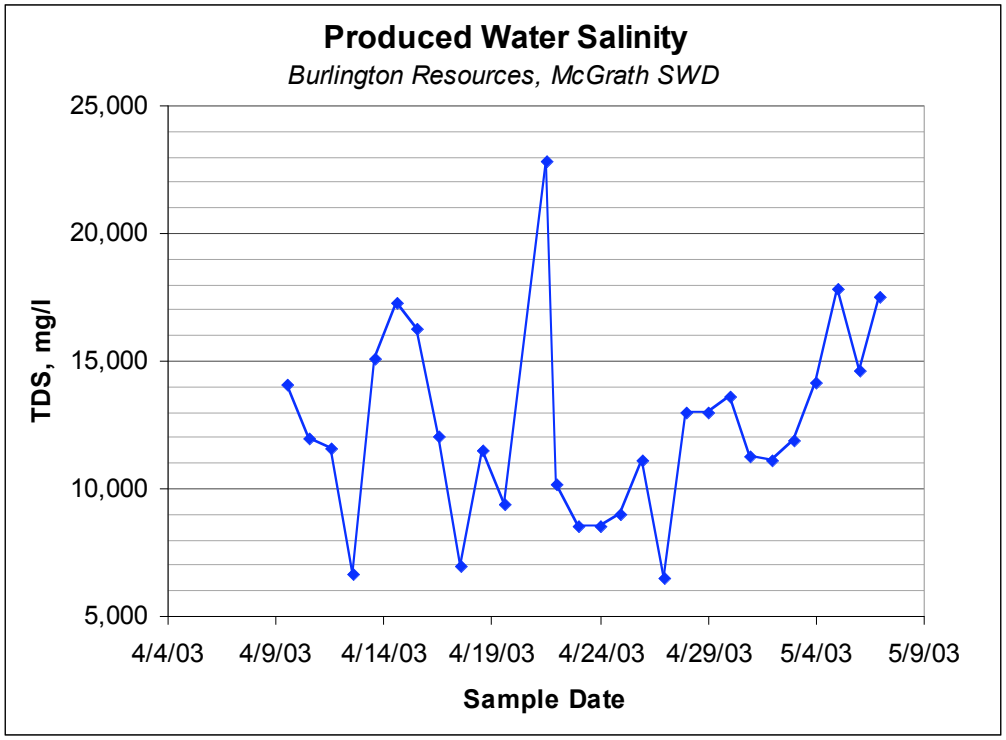
SWD Flow Schematic

SJGS Produced Water Reuse



Produced Water Collection & Conveyance Schematic

PNM – Produced Water Project - SJGS


Produced Water Salinity
Burlington Resources, McGrath SWD
25,000
20,000
15,000
10,000
5,000
TDS, mg/l
4/4/03
4/9/03
4/14/03
4/19/03
4/24/03
4/29/03
5/4/03
5/9/03
Sample Date

Project Implementation

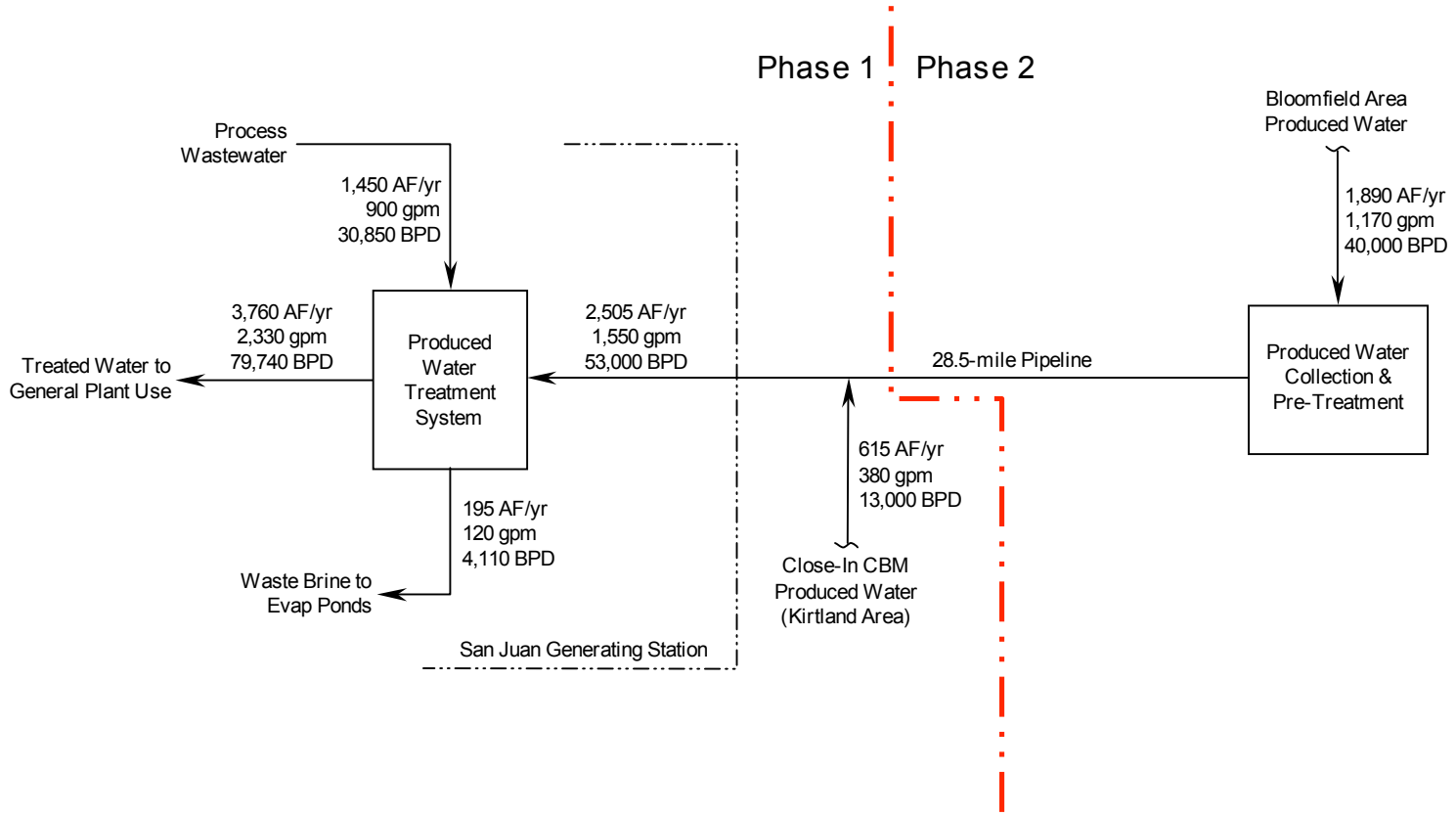
The project would be implemented in two phases.....

Phase 1

- An 11-mile pipeline would be build to collect water from Close-in producers (exclusively CBM production).
- Producers would inject filtered water into the line.
- Producer disposal costs would be reduced by $0.25/bbl.

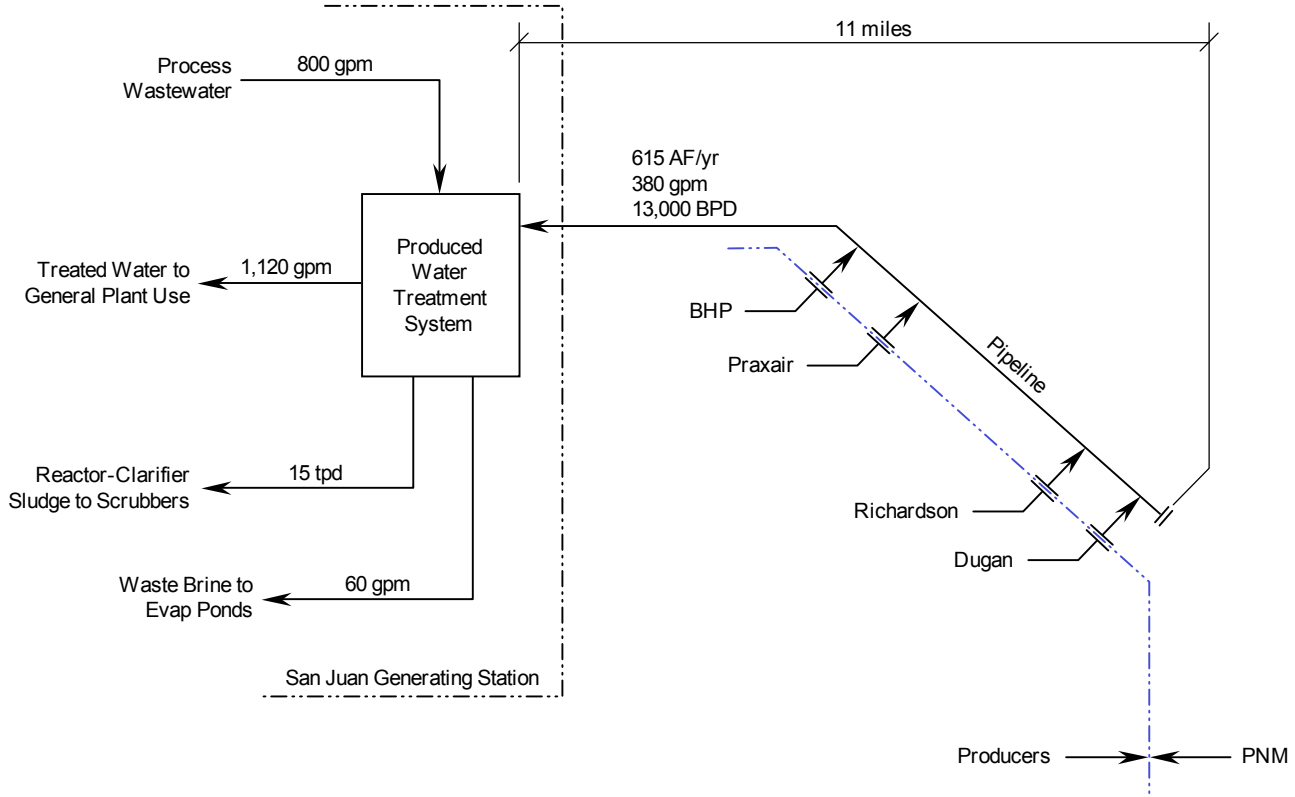
Phase 2

- PNM would extend the pipeline an additional 17.5 miles to Bloomfield.
- Burlington resources would refurbish two existing pipelines and install satellite collection stations to gather *theirs and other producer's water* in areas of heavy tanker-truck traffic.
- PNM would build a collection Center in Bloomfield to accept and pretreat water gathered by Burlington Resources.
- Producer disposal costs would be reduced by up to $1.00/bbl.
- Some SWDs could be put on stand-by and the life of costly injection wells ($1.5 to $2.5 million per well) would be extended.



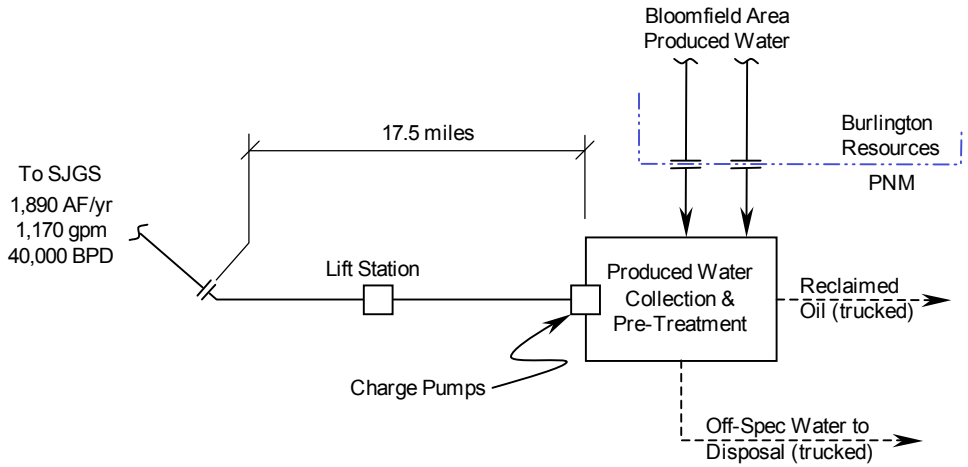
Produced Water Project –Phases 1 & 2

PNM – San Juan Generating Station



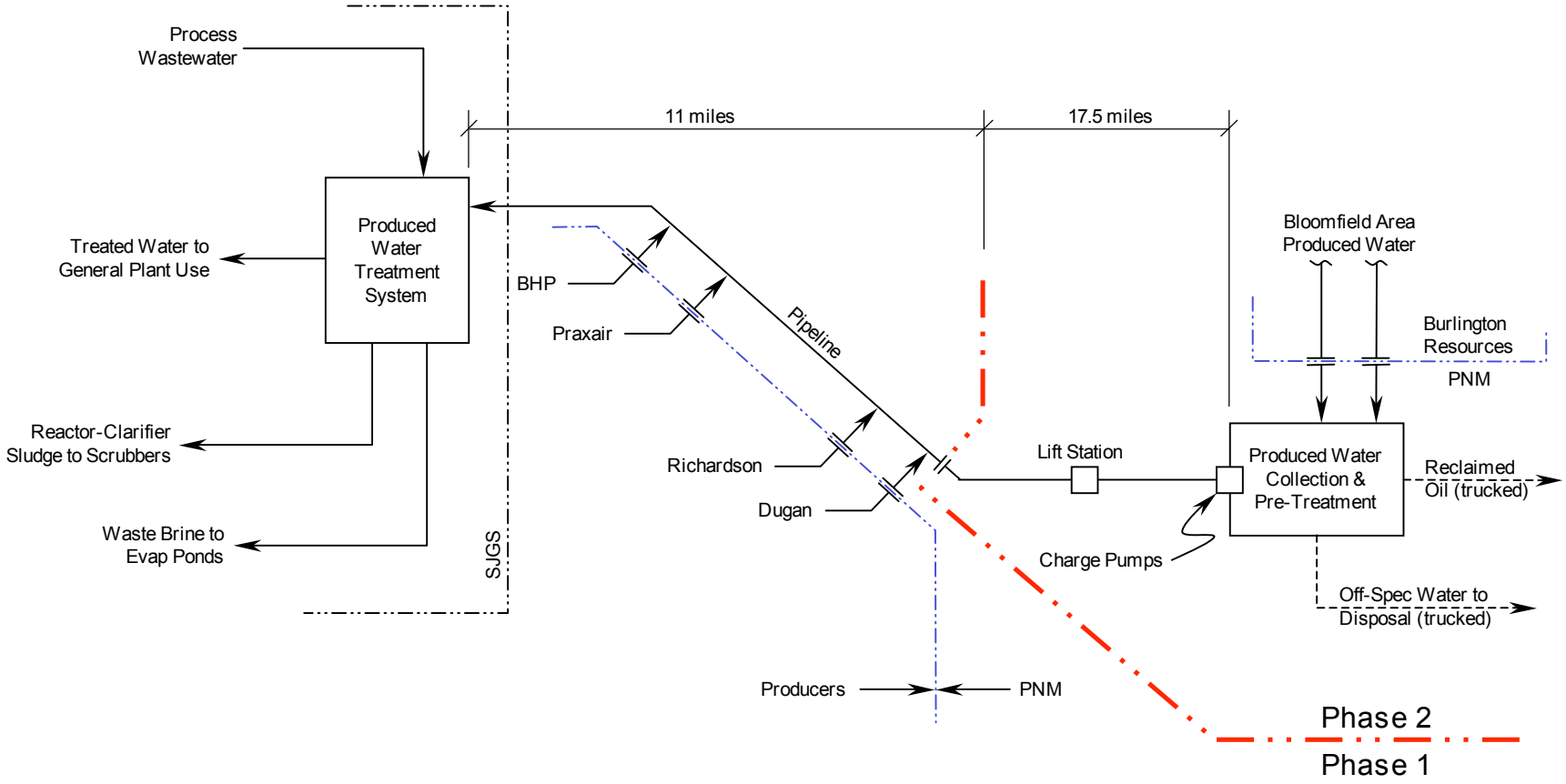
Produced Water Project – Component Schematic – Phase 1

PNM – San Juan Generating Station



Produced Water Project – Component Schematic – Phase 2

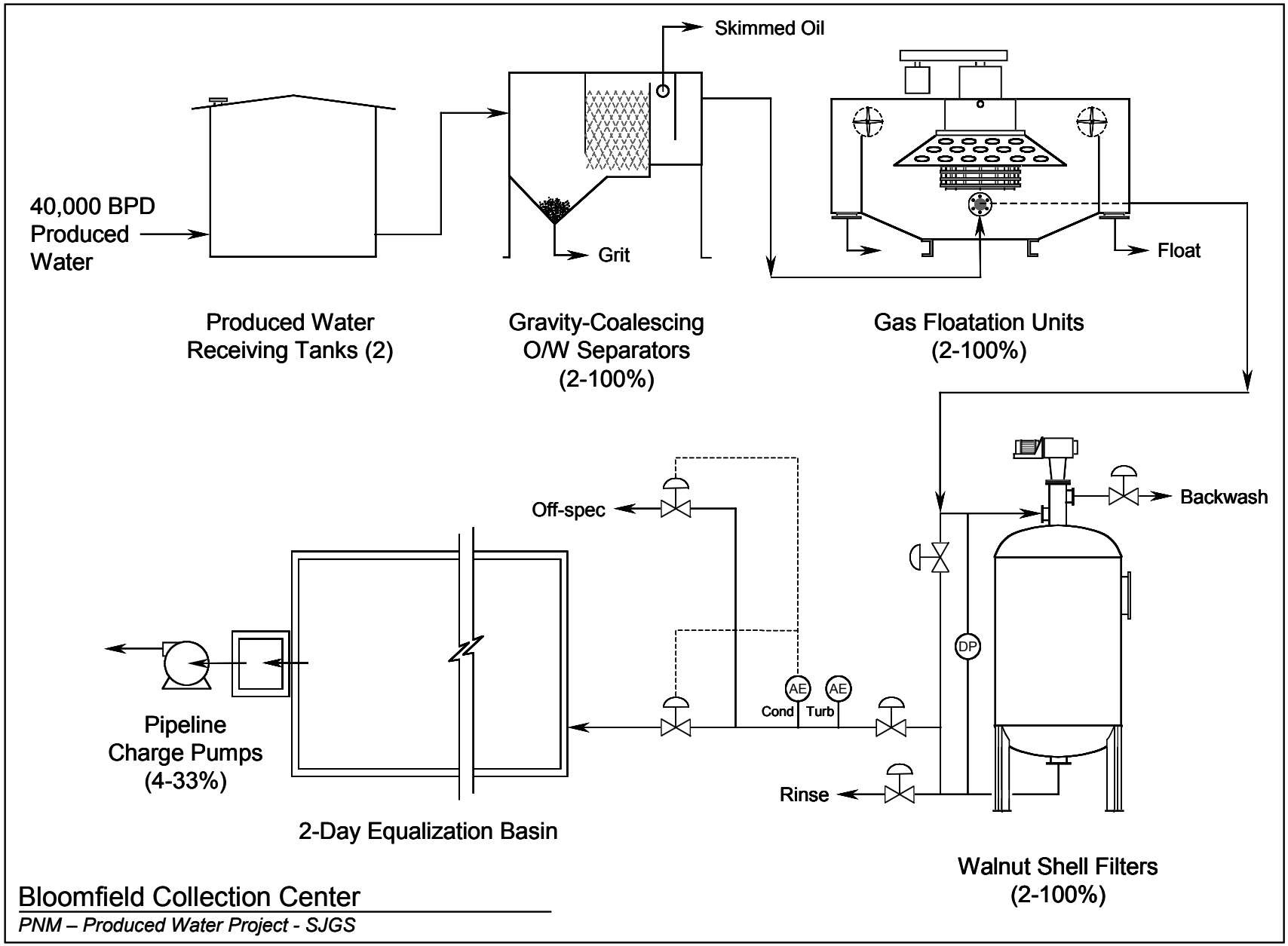
PNM – San Juan Generating Station



Produced Water Project – Component Schematic – Phases 1 & 2

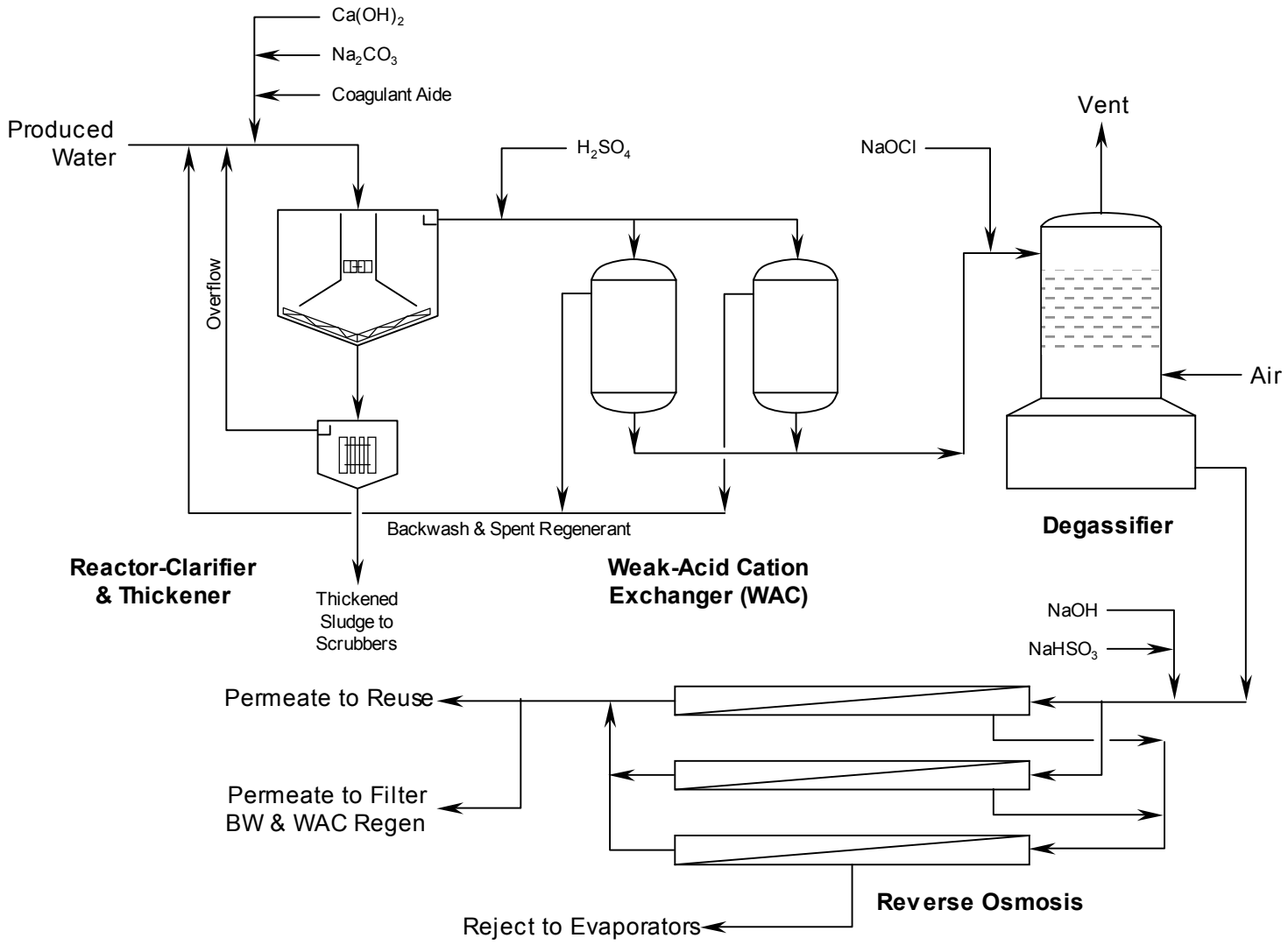
PNM – San Juan Generating Station

Produced Water Treatment



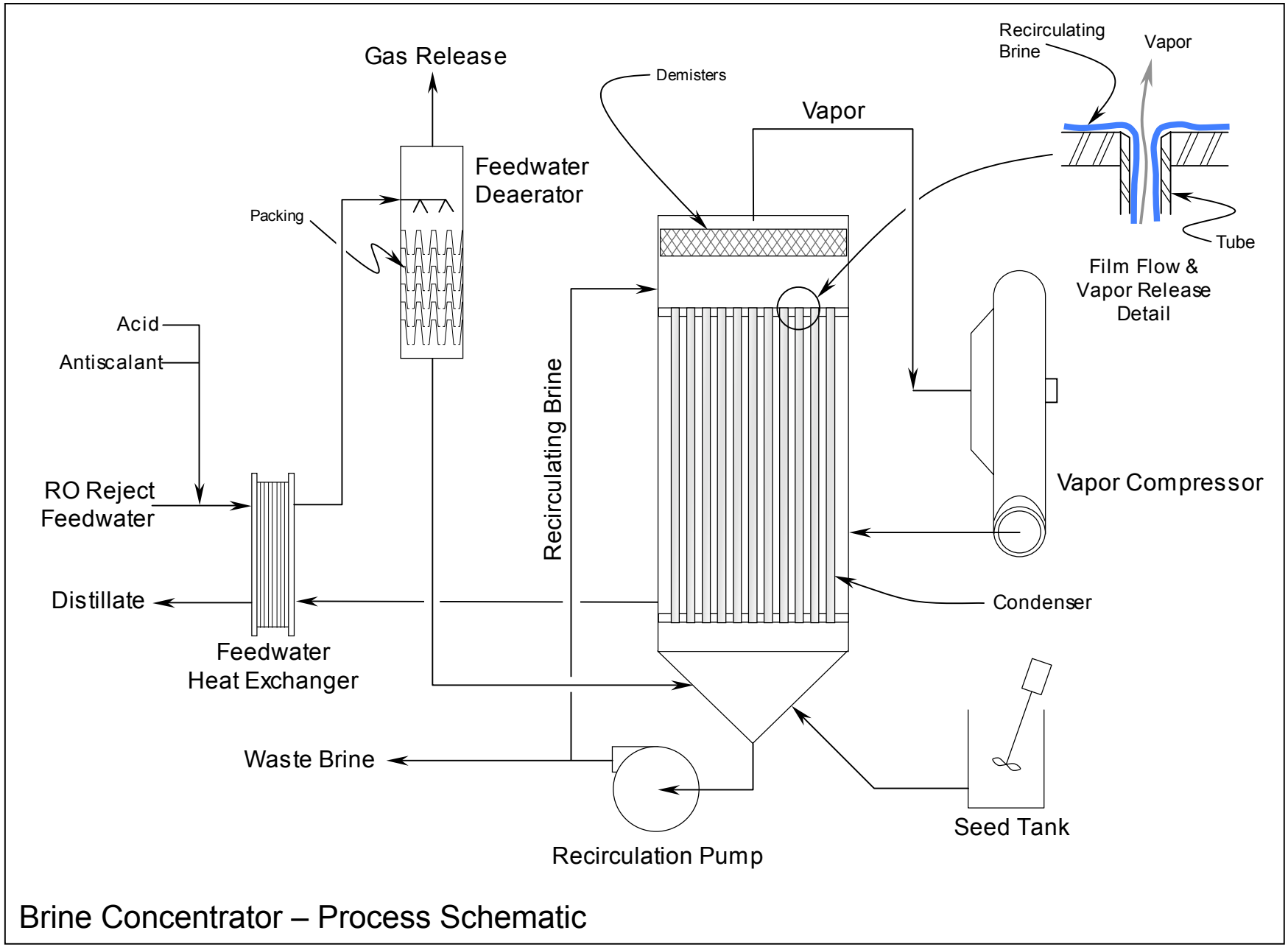
Bloomfield Collection Center

PNM – Produced Water Project - SJGS

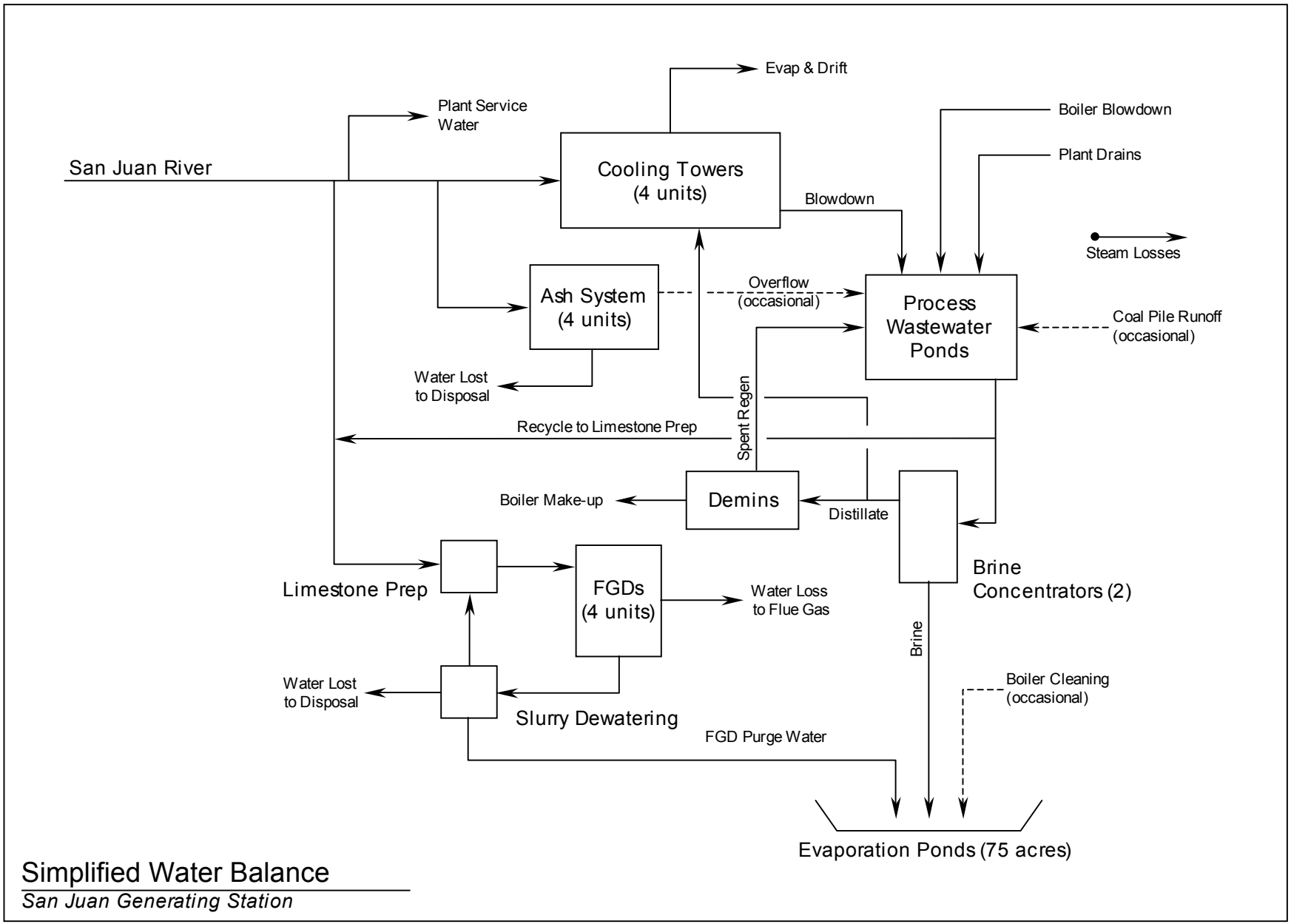


HERO System – Process Schematic

San Juan Generating Station

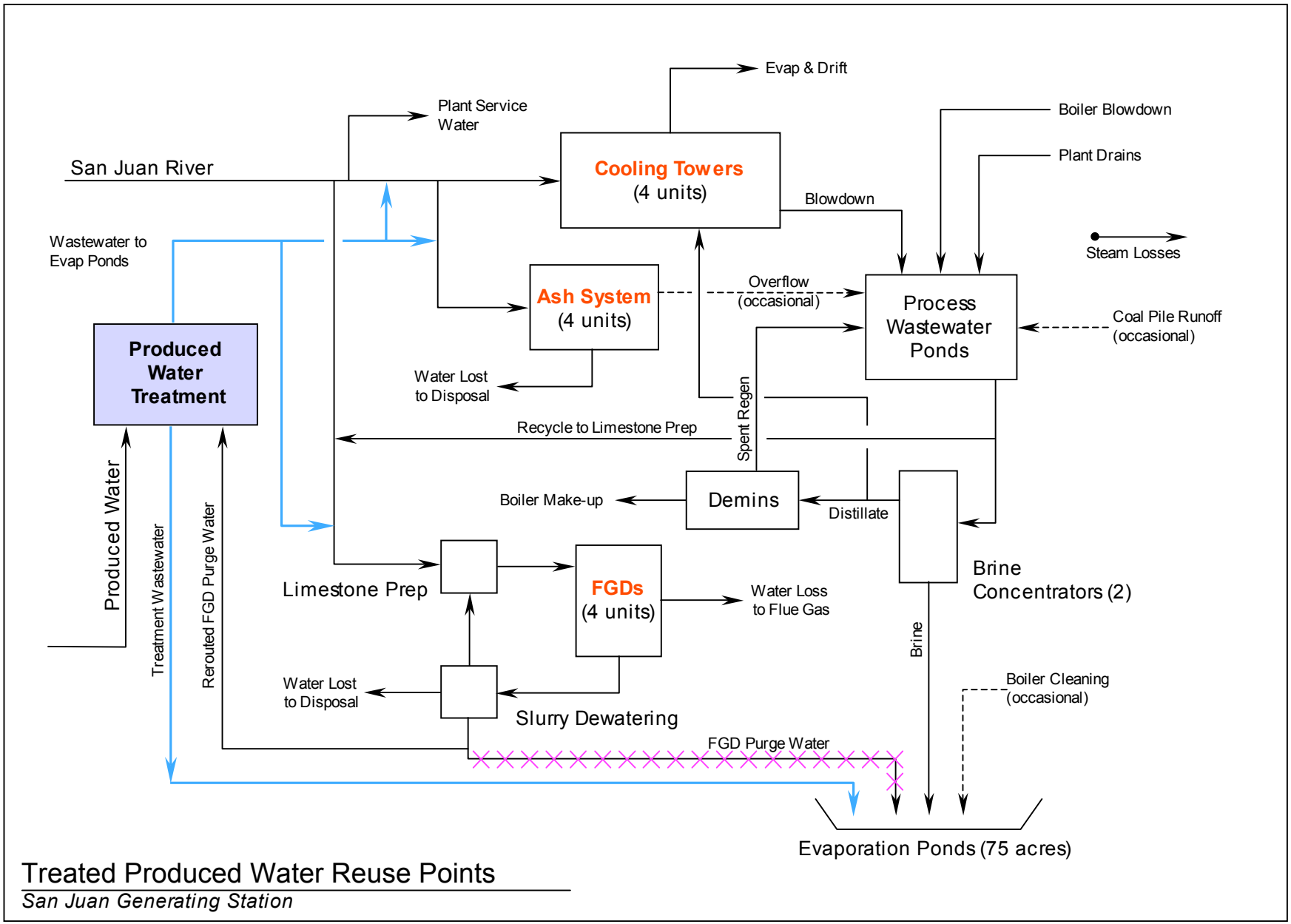


Brine Concentrator – Process Schematic



Simplified Water Balance

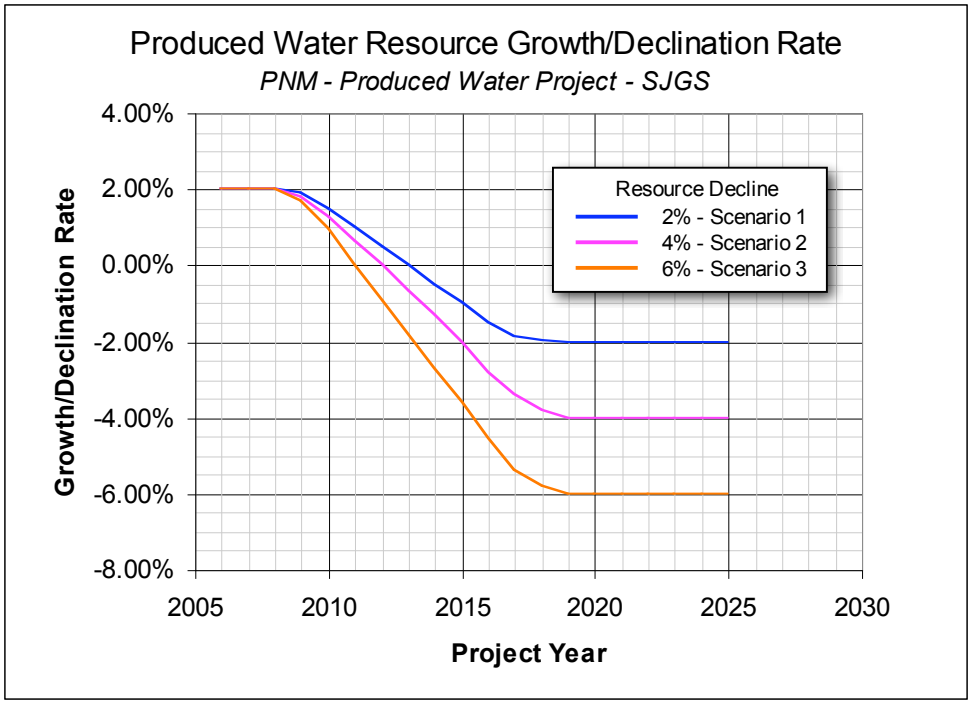
San Juan Generating Station

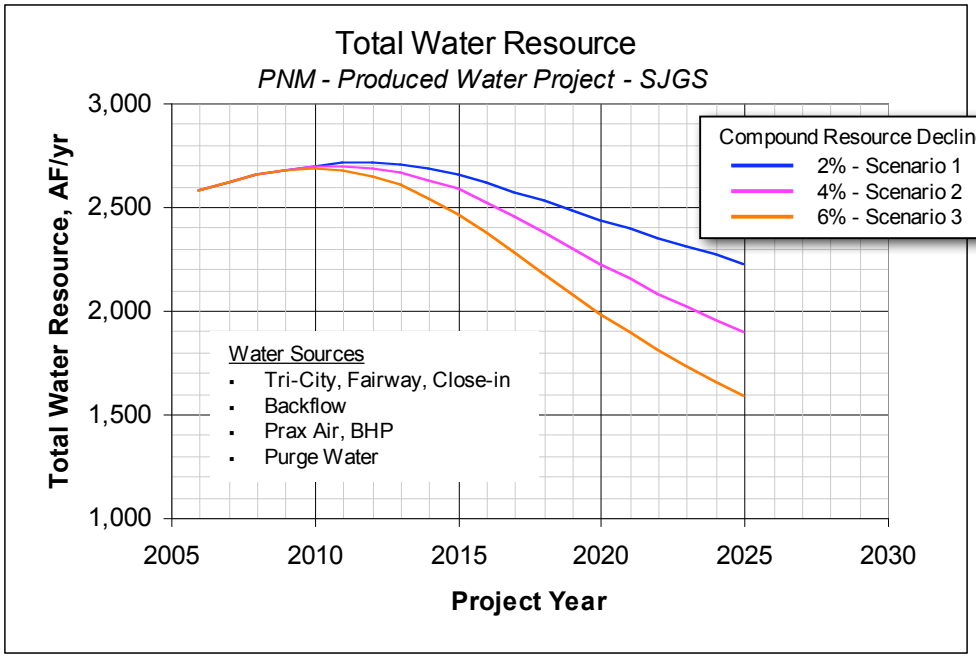


Treated Produced Water Reuse Points

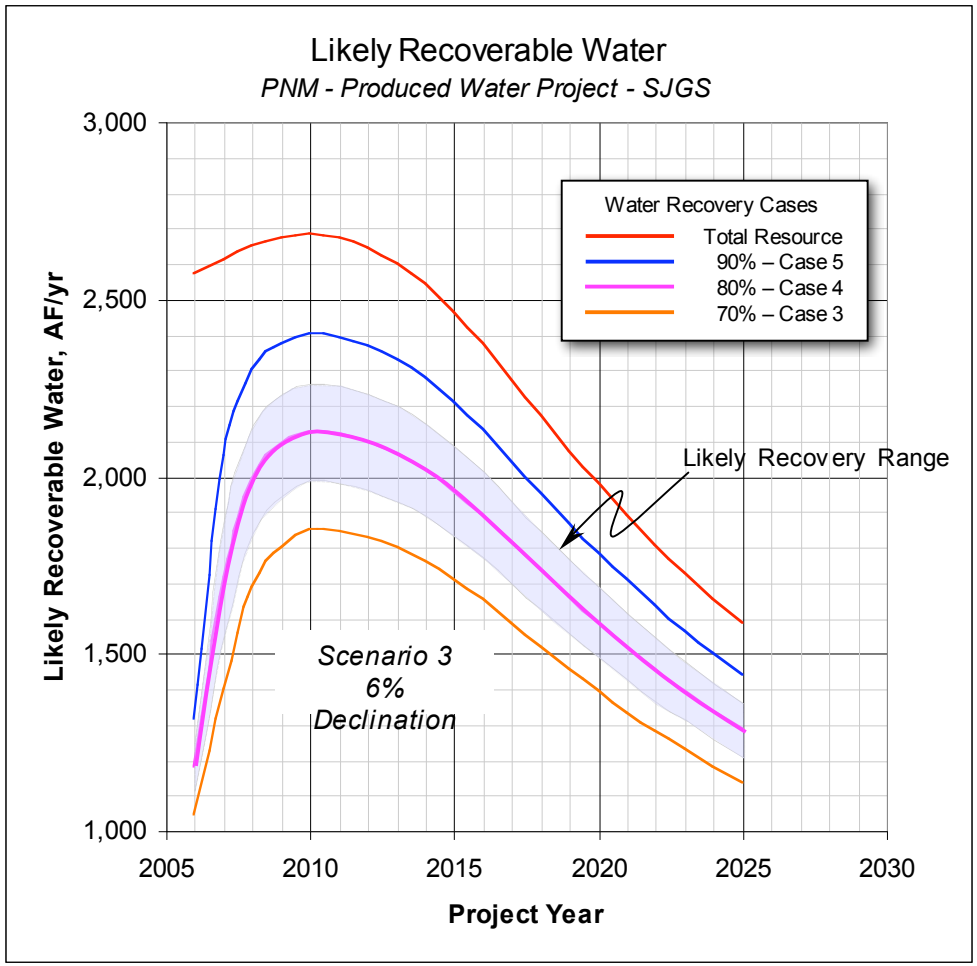
San Juan Generating Station

Economic Analysis


Produced Water Resource Growth/Declination Rate
PNM - Produced Water Project - SJGS
4.00%
2.00%
0.00%
-2.00%
-4.00%
-6.00%
-8.00%
Growth/Declination Rate
2005
2010
2015
2020
2025
2030
Project Year
Resource Decline
2% - Scenario 1
4% - Scenario 2
6% - Scenario 3


Total Water Resource
PNM - Produced Water Project - SJGS
Total Water Resource, AF/yr
3,000
2,500
2,000
1,500
1,000
2005
2010
2015
2020
2025
2030
Project Year
Compound Resource Decline
2% - Scenario 1
4% - Scenario 2
6% - Scenario 3
Water Sources
Tri-City, Fairway, Close-in
Backflow
Prax Air, BHP
Purge Water

Life-of-project recoverable water.....



Capital Costs Incurred by PNM

		Collection Center	14-inch Pipeline	HERO + BC 3	Total Project
Capacity, BPD		34,000	60,000	53,000	
Peak Conditions, BPD		30,670	44,710	48,130	
Equipment & Installation		$5,200,000	$12,900,000	$11,800,000	$29,900,000
Contingency	15%	$780,000	$1,940,000	$1,770,000	$4,490,000
NMGRT (1)	6.125%	$320,000	$790,000	$720,000	$1,830,000
PNM G&A (2)	5.5%	$290,000	$710,000	$650,000	$1,650,000
Total Project		$6,590,000	$16,340,000	$14,940,000	$37,870,000

Notes…..

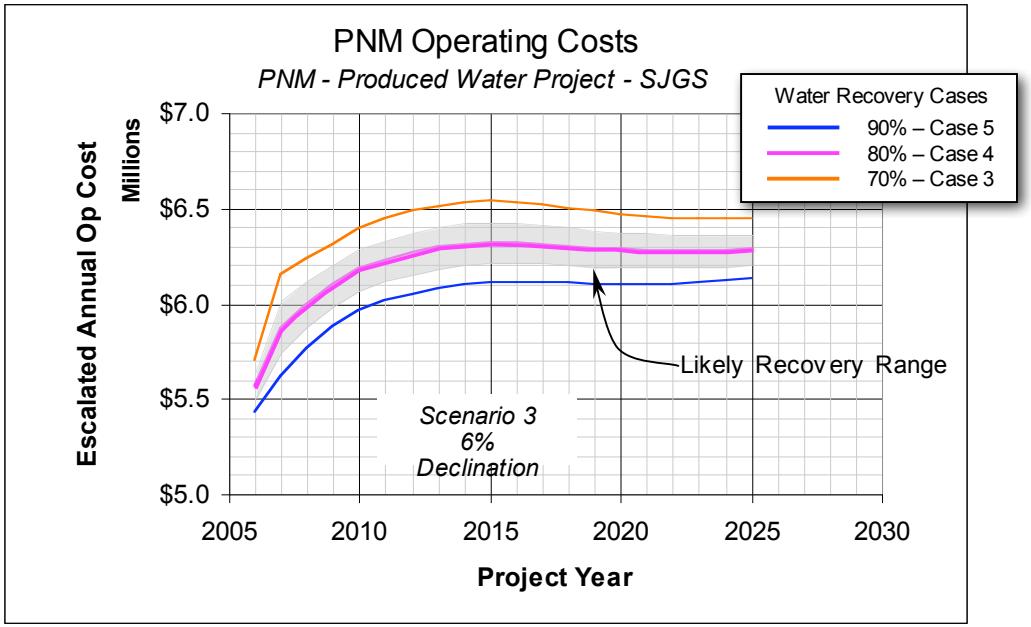
1. NMGRT is the New Mexico Gross Receipts Tax.
2. G&A is a "general and admistrative" charge applied to all PNM projects.

Total Project Capital Costs

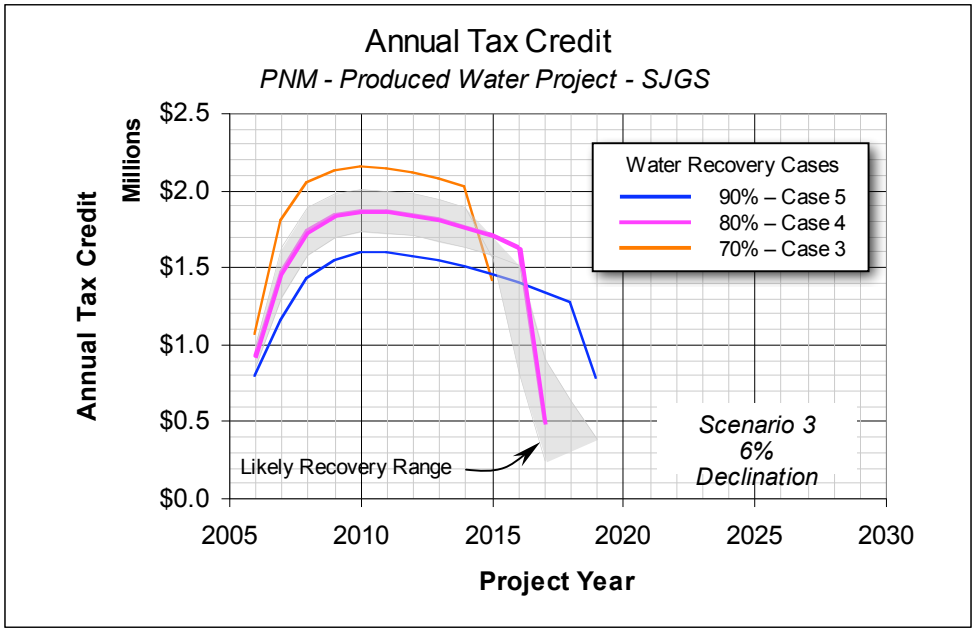
BR	Gathering system to Collection Center	$5,000,000
Dugan	Inject into pi peline	$100,000
Richardson	Inject into pipeline	$100,000
PNM	Collection Center, pipeline & treatment	$37,900,000
Total Project		$43,100,000

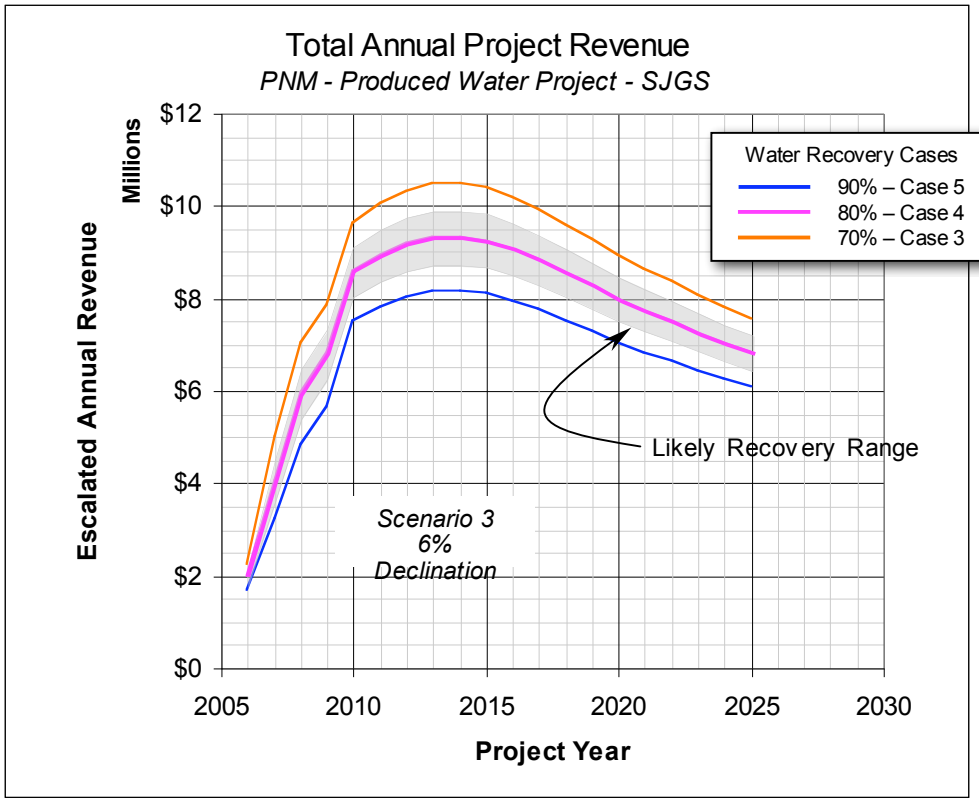
Notes.....

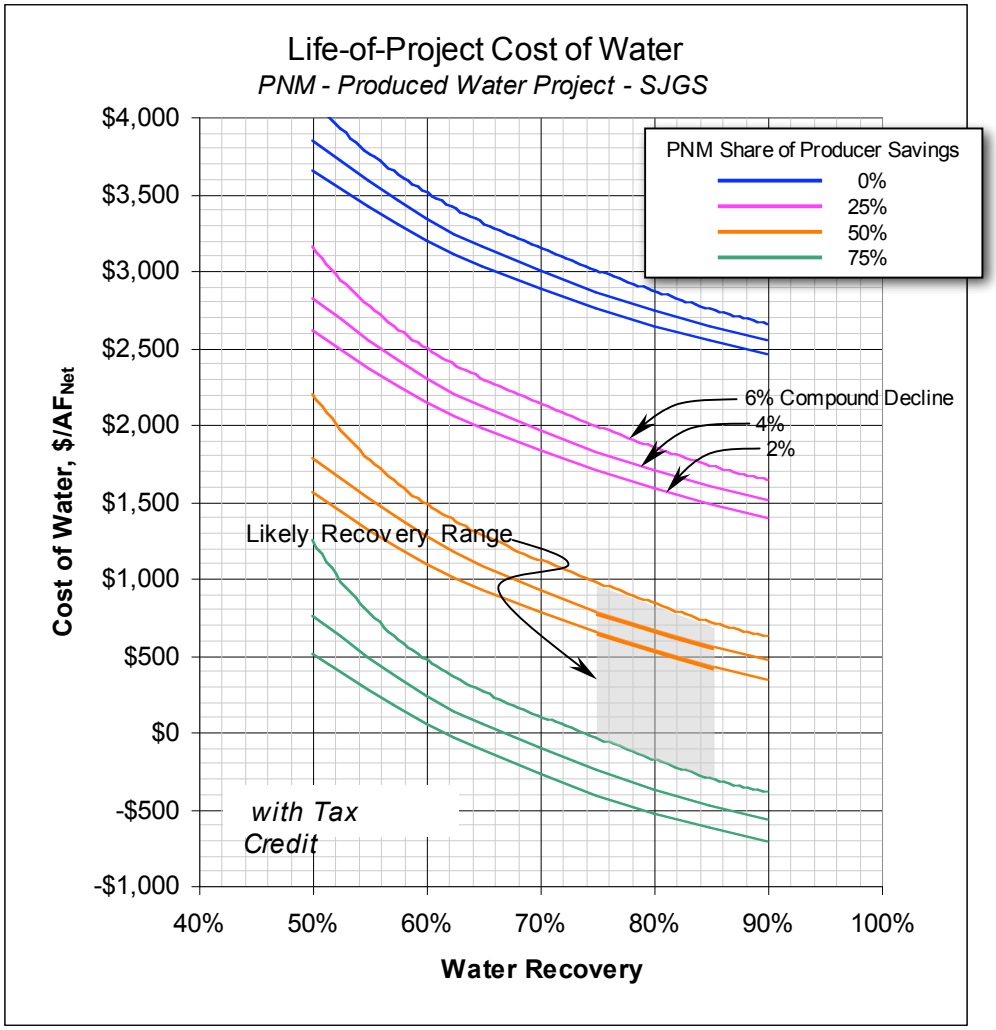
1. Installation costs for Dugan and Richardson are most likely high.


PNM Operating Costs
PNM - Produced Water Project - SJGS
Water Recovery Cases
90% – Case 5
80% – Case 4
70% – Case 3
Escalated Annual Op Cost
Millions
$7.0
$6.5
$6.0
$5.5
$5.0
2005
2010
2015
2020
2025
2030
Project Year
Likely Recovery Range
Scenario 3
6%
Declination

PNM is negotiating with the State of New Mexico for a tax credit of $1,000/AF. The tax credit would have an annual limit and life-time cap.




Total Annual Project Revenue
PNM - Produced Water Project - SJGS
Escalated Annual Revenue
Millions
$12
$10
$8
$6
$4
$2
$0
2005
2010
2015
2020
2025
2030
Project Year
Water Recovery Cases
90% – Case 5
80% – Case 4
70% – Case 3
Likely Recovery Range
Scenario 3
6%
Declination


Life-of-Project Cost of Water
PNM - Produced Water Project - SJGS
PNM Share of Producer Savings
0%
25%
50%
75%
6% Compound Decline
4%
2%
Likely Recovery Range
with Tax Credit
Cost of Water, $/AF Net
$4,000
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
-$500
-$1,000
40%
50%
60%
70%
80%
90%
100%
Water Recovery

Project Economics.....

- Produced water project economics are based on capital and operating costs as well as a revenue stream.
- PNM's operating costs include treatment chemicals, power, labor, materials, maintenance and *capital recovery costs*.
- Revenue streams offset PNM operating costs.
- The first revenue stream would be a tax credit of $1,000/AF provided by the State of New Mexico (the tax credit would have an annual limit and life-time cap).
- The second revenue stream would be a share of the oil-producer savings derived from reduced disposal of produced water and deferred costs of injection wells.
- Depending on the revenue scenario, the 20-year, life-of-project costs would vary as follows:

50-50 Share of producers savings with the New Mexico tax credit	$720 to $970/AF ($125 to $150/AF)*	$1.3 to $1.7 million/year
50-50 Share of producers savings without the tax credit	$1,200 to $1,500/AF ($160 to $200/AF)	$2.0 to $2.6 million/year
No revenue streams	$2,500 to $3,000/AF ($260 to $330/AF)	$4.3 to $5.1 million/year

**Blended water costs – San Juan River @ $75/AF plus treated produced water.*

PNM Project Benefits…..

- Conserve river water for other beneficial uses in New Mexico.
- Enable the San Juan Generating Station to be more drought resistant.
- Avoid costly fuel-delivery penalties and power purchase costs.

Oil & Gas Producer Benefits.....

- Reduce the volume of produced water that must be handled and injected.
- Establish an infrastructure to minimize produced water injection in the San Juan Basin.
- Establish area-wide opportunities to reduce produced water handling and injection costs.